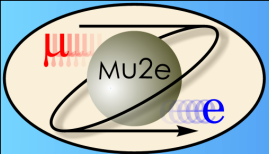


Test beam studies of CRV prototype for Mu2e

Richard Bomgardner, Craig Dukes, Martin Frank, Doug Glenzinski, Stephen Goadhouse, Craig Group, Sten Hansen, Andy Hocker, Yuri Oksuzian, Jesus Orduna, Paul Rubinov, Ryan Riddel, Giovanni Tassielli, Julie Whitmore

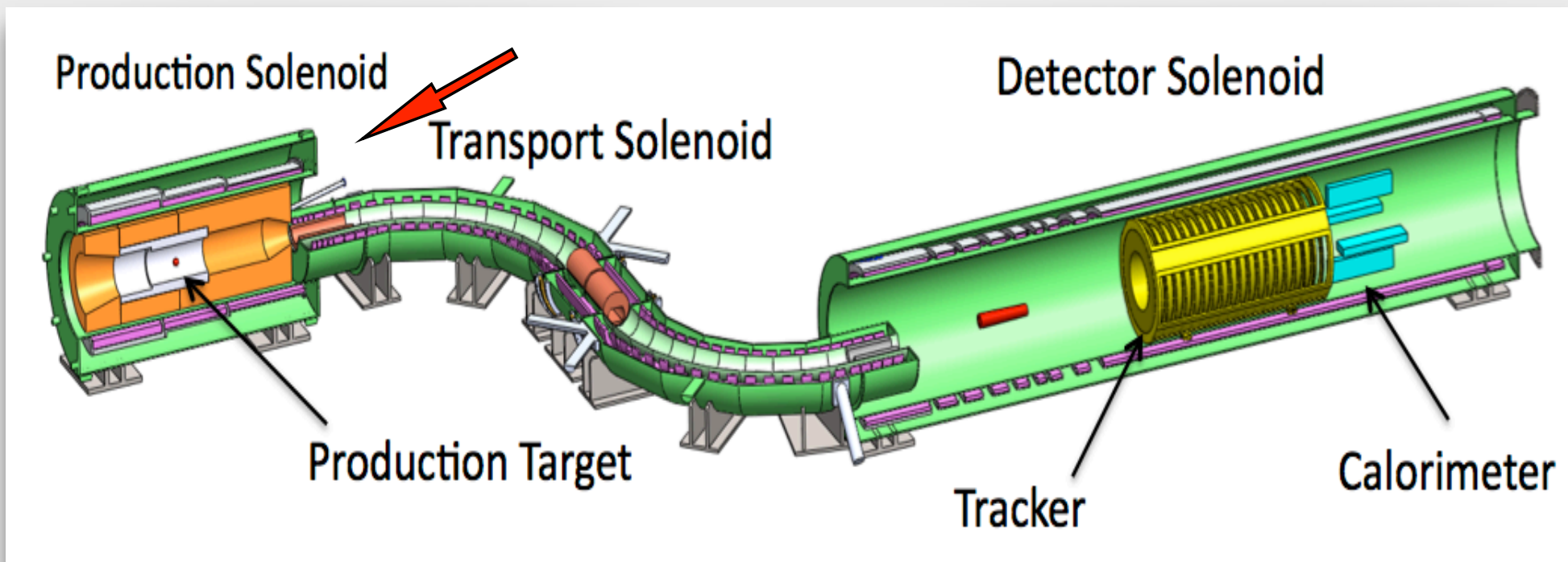
Dec 9, 2013

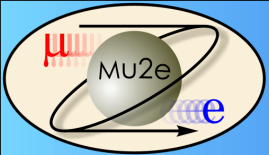


Mu2e



- Mu2e: neutrino-less muon decay experiment
- Status:
 - Successfully passed CD1
 - Preparation for CD2/3
 - Start data taking at end of 2020
- Designed sensitivity of $R_{\mu e} < 8E-17$
 - 4 orders of magnitude more sensitive than existing limit
- Total expected background is 0.5 event for the 3 years of data taking

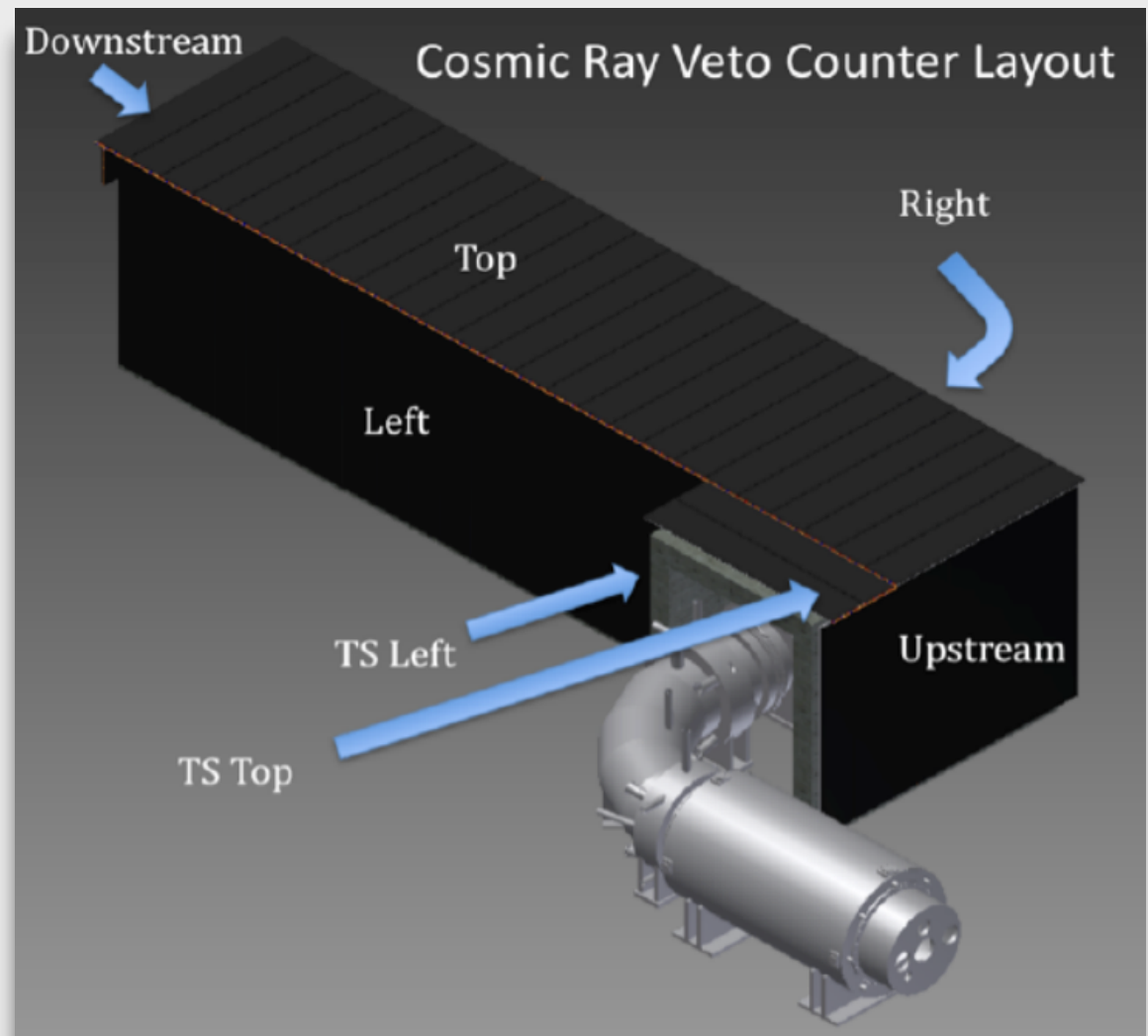
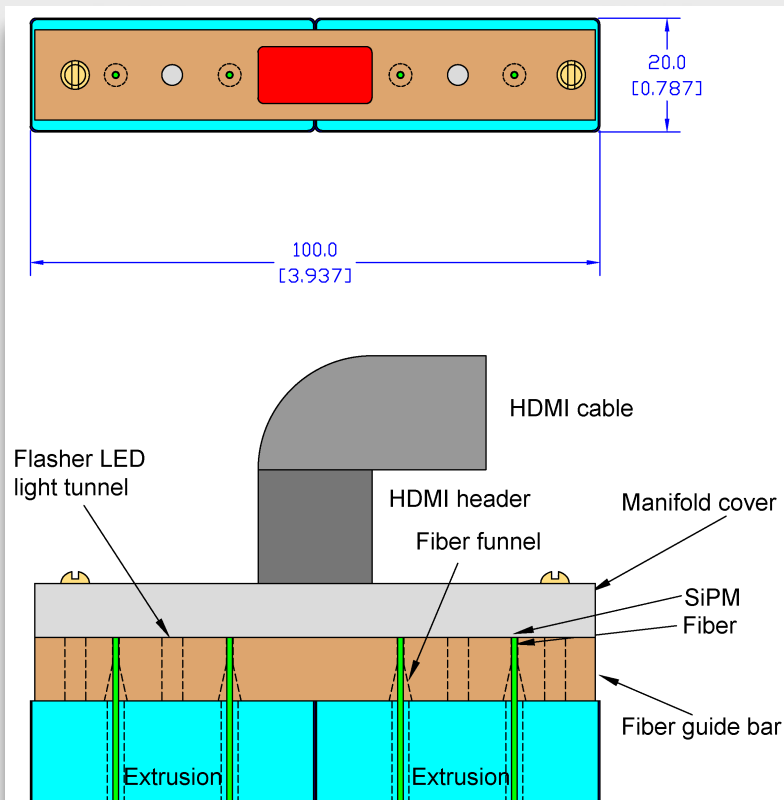


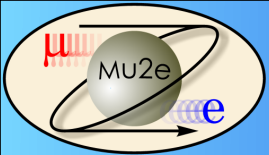


Cosmic Ray Veto



- Mu2e expects 1 signal-like event per day induced by cosmic rays
- Cosmic Ray Veto(CRV) needs to reject 99.99% of cosmic rays
- CRV consists of 4-layer scintillator counters, covering 400 m² of detector solenoid
- Main challenges:
 - Sufficient light yield
 - Radiation hot environment





CRV Test Beam setup

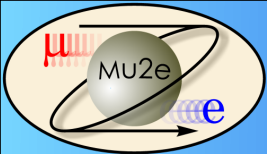


- Measurements at Fermilab Test Beam Facility(big thanks) in October, using 120 GeV proton beam:
 - Absolute PE yields from 2 cm counter with 1mm WLS fiber
 - Glued vs loose fiber
 - Effect from cracks
 - Vertical scans
 - SiPM types

Two di-counters back-to-back

3-layer short module

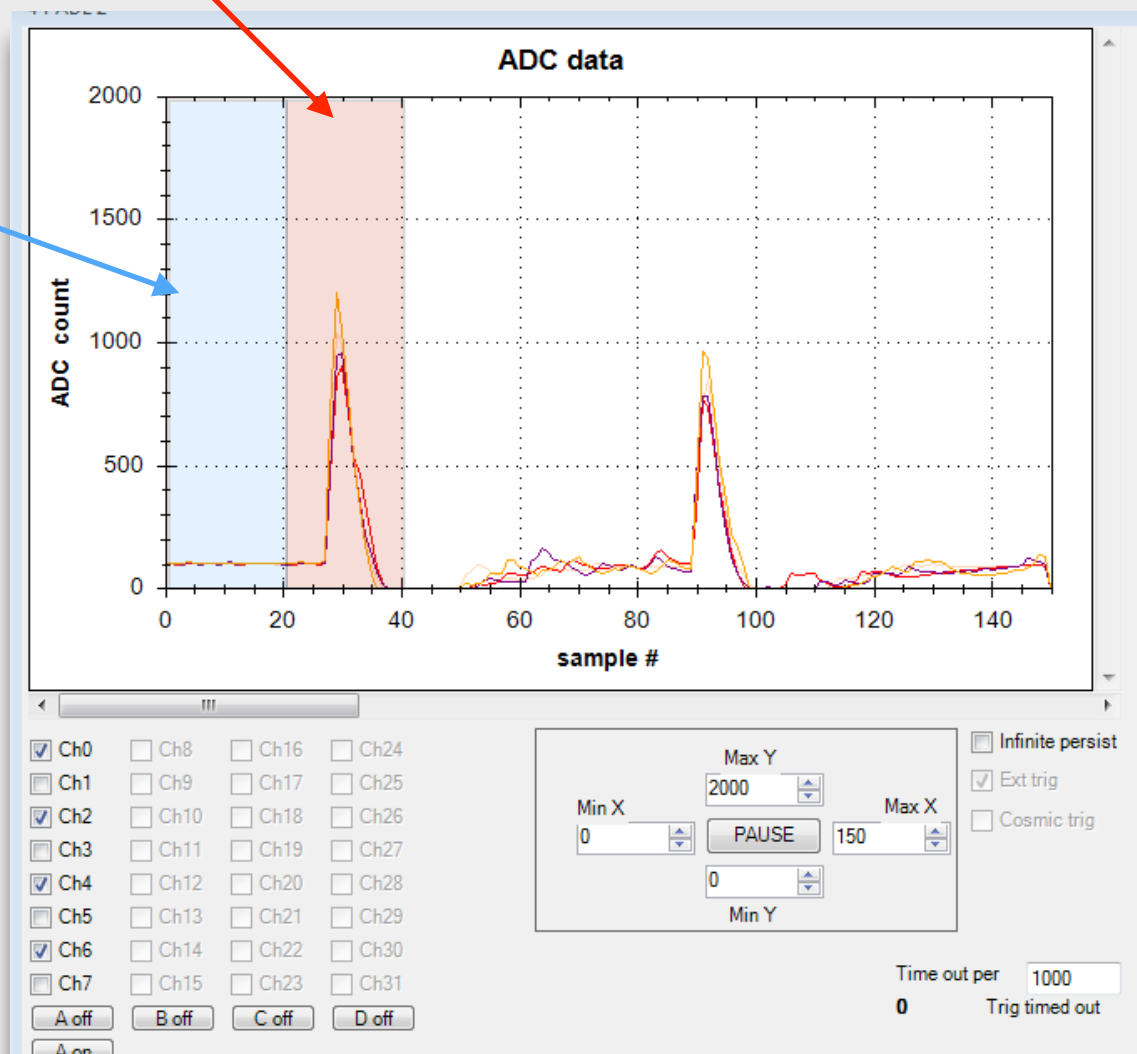


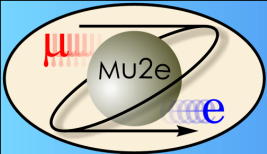


DAQ



- DAQ: 12-bit, 75 Mhz sampling digitizer designed by P.Rubinov and T.Fitzpatrick
- Trigger on the coincidence from scintillator counters in front and back
- Signal - max ADC value in trigger window
- Calibration - max ADC value in background region





Results



- Useful data was collected at TBF, using CRV prototype
- CRV prototype provides 30 PE per SiPM at read out end
 - The requirement is 50 PE(TBD)
- Larger fiber and SiPM needs to be considered
 - Slight increase in CRV budget
- Plan to get required PE yield with the next version of CRV prototype

Typical light yield distribution from SiPM for CRV prototype

